RECENT TRENDS IN MECHANICAL ENGINEERING -2016
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY [IJIERT]
ISSN: 2394-3696
29th Feb-2016

WEAR MONITORING OF INSERT TYPE MILLING TOOL BY IMAGE PROCESSING TECHNIQUE

Devanshi A Jhaveri

M.E. Scholar (Manufacturing), A.G.Patil Institute of Technology, Solapur

Prof. Rahul Annapanyawar

Professor A.G.Patil Institute of Technology, Solapur

ABSTRACT

Strong competition forces companies implement various productivity improvement efforts. Tool wear measurement is of great importance in machining industry, as affects the surface quality, dimensional stability and production costs of the material components. has been developed in this study vision system based on digital image processing for the measurement of tool wear. Tool wear images were captured and flank wear was measured using grayscale analysis of that image. In order to increase the lead time (ie, minimization of wear of the tool) and to remove more material for the required surface roughness in machining parameters such as speed, feed and depth of cut should be optimized. Optimization has great practical significance especially for editing. to this result an approach based on overall equipment effectiveness (OEE) with the aim of achieving increasing productivity in the manufacturing system level required.

Key Words – Wear Measurement, Surface roughness.

INTRODUCTION

Many authors used machine vision as a system for studying tool wear. Kurada et al. [1] designed a machine vision system that can measure flank wear. They were using image threshold to bring out wear area.

Kerr et al. [2] used a monochrome CCD camera to capture images from the tool nose. Methods included edge operators, texture information, histogram analysis, Fourier transform and fractal properties of the image were tested to compare their results in extracting the wear information from the tool. Texture information was found to be the most useful and accurate in measuring the extent of the wear. However, the system was not implemented to be used in-cycle, since the tool had to be removed from the tool holder.

CUTTING TOOL WEAR AND MEASUREMENT OF TOOL WEAR:

Norm ISO 3685: 1993 is the standard for the measurement of the wear and tear wear experiments with the use of a single-point turning tool, the word "single point" refers to the fact that the tool cuts the material with a single Figure 1 shows a .. cutting tool . the sequence of the sides is dependent on the application. Major edge is the cutting edge, while small flank faces, the new cutting edge and the face to be cut receives the material and forms chips. the type of cutting tool presented Figure 1 has four usable cutting edges, one on each side of the tool. of these, the most useful for the measurement of the main and the flank face as the standard threshold values indicates wear experiments of the type of wear occurs on both sides. the standard also defines four definitions, namely, wear of the tool, tool wear measure, tool life and tool life criterion which is defined as follows:

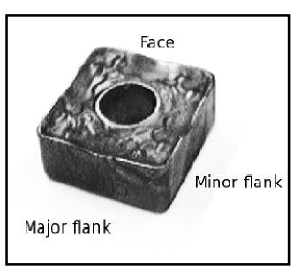


Figure 1: Image of cutting tool

a. Tool wear :

The change of shape of the tool from its original shape, during cutting, resulting from the gradual loss of tool material or deformation

b. Tool wear measure :

A dimension to be measured to indicate the amount of tool wear

c. Tool-life criterion :

A predetermined threshold value of a tool wears measure or the occurrence of a phenomenon.

d. Tool life :

The cutting time required to reach a tool- life criterion. According to the ISO standard 3685:1993, there are multiple types of wear and phenomena, which can cause tool-life criterion to be fulfilled. Most important of the wear types are flank wear and crater wear.

Flank wear is present in all situations and it is the best known type of wear. It can be found on the major flank of the tool. Crater wear appears on the face of the tool as a crater. Crater wear is the most commonly found wear on the face of the tool. The wear process itself changes under the influence of different conditions. However, three main factors contributing to the wear are known: adhesion, abrasion and diffusion.

Adhesion occurs when the work material, that the tool is cutting, welds onto the tool. This happens because of the friction between the tool and work material, which generates heat. When these welds are broken, small pieces of the tool are lost. Abrasion is mechanical wear resulting from the cutting action, where the tool grinds itself on to the work material. Diffusion wear occurs on a narrow reaction zone between the tool and work material. In diffusion wear the atoms from the tool move to the work material. This usually accelerates. The other two wear processes as the tool material is weakened. Figure 2 shows the general curves of flank wear. The wear is typically characterized by rapid initial wear, a linear increase of the wear in the middle of the tool life and finally a rapid increase of the wear rate before the tool breaks completely. While the general shape of the curve stays the same, cutting conditions or cutting parameters affect the tool life, i.e. the gradient of the curve, especially the linear section. Most important cutting parameters in relation to tool wear are cutting speed, denoted by V, and cutting feed, denoted by f. Of these speed is considered to have the most effect on the tool life.

The importance of cutting speed can also be seen from the Taylor's equation as the formula relies only on the cutting speed to estimate tool life.

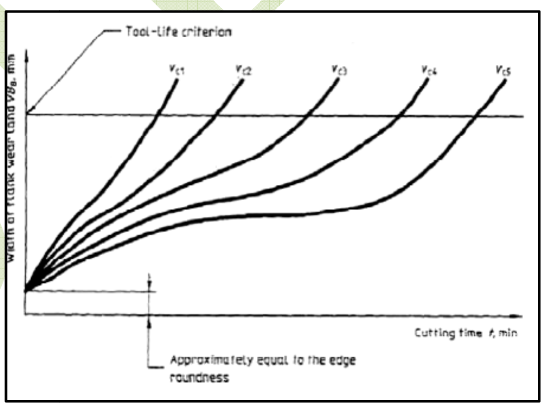


Figure 2 :Flank wear progress as a function of time.

The effects of cutting speed can be seen from Figure 2. The Cutting speed is usually expressed in meters per minute and can range up to 500 m/min. The standard gives a limit to the cutting speeds by limiting the minimum tool life to 5 minutes or to 2 minutes when using a ceramic tool.

The cutting feed is expressed as millimeters per revolution, ranging from 0.1 to 0.9 mm/rev Standard has defined the maximum feed to 0.8 times the corner radius of the tool. To be able to measure the wear, especially flank wear, a few variables must be known. Most important variables are corner radius (rc) and depth of cut (b).

These are represented in Figure 3. This figure is depicting the tip or nose of the tool viewing it from the top. The arrow in the figure represents the cutting direction.

The variable rc tells the corner radius, i.e. how round the tip of the tool is. b on the other hand tells the depth of the cut used to cut the work-piece. These are used in measuring the flank wear. The measurements defined for flank wear in the standard are shown in Figure 4. The figure depicts the major flank of the tool from the side and the tip of the tool lies at the top.

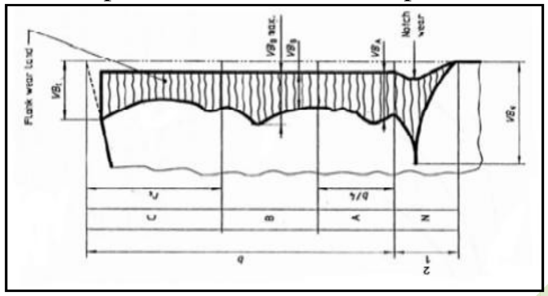


Figure 4: flank wear Measurement

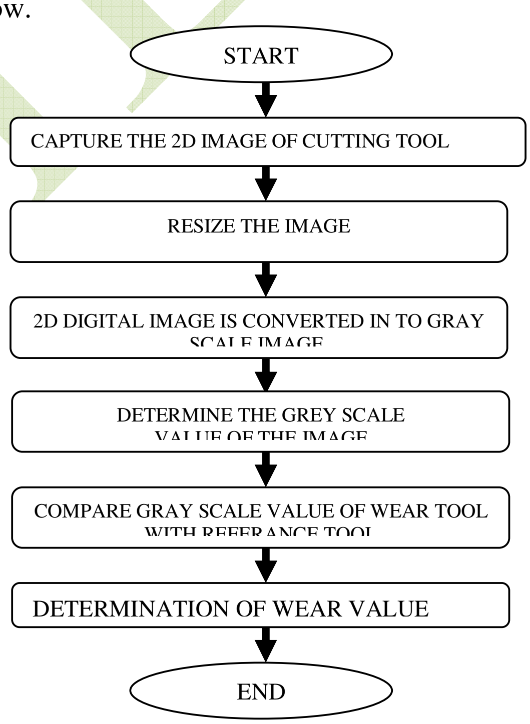
In Figure 4 two measures are the most important, as they are designated in the standard to be tool-life criterions. These measures are VBB and VBB max. Besides these most important measures, also VBC is measured, which is considered to be the maximum wear width in zone C. VBB and VBB max. Govern the tool-life by following criteria:

a) The maximum width of the flank wear land VBB max. = 0.6 mm if the flank wear land is not regularly worn in zone B.

b)The average width of the flank wear land VBB = 0.3 mm if the flank wear land is Considered regularly worn in zone.

METHODOLOGY:

Before the start of the operation, in the function insert captured and needs to be taken as a reference image. The tool was provided was done in the tool holder of the machine and the machining processes. The parameters speed, feed and depth of cut of operation were recorded. After each hour interval machining the insert was removed and the image was captured. the wear depth was calculated on the basis of the focus meter by setting of Z1 and Z2 in the vision system. the RGB photograph had been taken out of the vision converted image in shades of gray and the gray values are calculated with the aid of MAT Lab. the methodology of flow chart is listed below.



EXPERIMENTAL SETUP:

The operation tests are performed on CNC-lathe machine carried out under dry condition and used in sawing the cutting insert was carbide tool. The coated instrument chosen for the test operation was titanium nitride (TIN). The main characteristics of titanium coating insert its high strength, hardness and high corrosion resistance against acid, alkali and chlorine. for tool making images RAPID I machine vision system was used.

The vision system work table movement in the X-axis 200mm, Y-axis 150mm, Zaxis 90mm, which is controlled by joystick. The resolution of vision inspection system is 1 micron (min) and the maximum weight limits placed on the table of the track up to 5kg (max). the system has a magnification in the order of 18X, 67Xand120X with variable zoom lens piece and up to 240x with 2x objective lens. Lighting System solid state lighting fourth quadrant with provisions for enhancing surface feature / profile grinding. The image was captured by digital camera with 1280 x 1024 pixel resolution.

RESULTS:

Sr no.	Tool No	Reference image gray value	Wear tool gray value	Wear measurement	Wear value for one pixel
1	TN1	78.94	74.68	0.06	82.7
2	TN2	78.94	73.84	0.07	82.59
3	TN3	78.94	72.23	0.99	71.88
4	TN4	78.94	71.49	0.115	66.31
5	TN5	78.94	71.02	0.124	66.02
6	TN6	78.94	70.67	0.131	63.87

CONCLUISION:

The online tool wear was determined by gray scale analysis for general machining condition. Tool wear can easily be determined for each instrument by the image of that particular tool simply capture and compare reference image of the same tool with. The gray scale value of the reference image and worn-out image is determined and also the measurement of the wear was made. The same program can be used for online machine system as some extra features in the program such as edge detection algorithm, reducing noise and orientation of the tool.

REFERENCES:

1) Kurada.S., and Bradley.C., A review of machine vision sensors for tool condition Monitoring, Computers in Industry,1997, 34(1):55–72.
2) Kerr.D., Pengilley.J., and Garwood.R., Assessment and visualization of machinetool wear using computer vision, International Journal of Advanced Manufacturing Technology,2006,28(7-8):781–791.
3) International Organization for Standardization. Tool-life testing with singlepoint turning tools, 1993, ISO 3685.
4) Fadare.D.A. et al, Development And Application of A Machine Vision System for Measurement of Tool Wear.
5) Yu-Teng Liang.et al., Tool wear monitoring basis of machine vision system, Aug 2005.
6) Jeon.Jj.U., and Kim.S.W., Optical flank wear monitoring of cutting tools by image processing, 1988.
7) T.N. Loladze, Of the theory of diffusion wear,Annals CIRP 30 (1)(2008)

ISSN: 2394-3696
29th Feb-2016